man had fallen upon a method which scarcely differed from his except in its forms of words and symbols.

It is not known how far Collins was in the confidence of Leibniz, but it has been noted that following Collins's death in November, 1683, appeared the *first publication* of Leibniz's calculus, in the "Leipzig Acts" for 1684, essentially as it was given to Newton in 1677.

Additional force is given to the supposition that Leibniz saw Newton's compendium in 1673 by the similarity of the circumstances to those which relate to German propaganda as it has been disclosed by the recent war, a similarity so striking, that one hardly realizes that the period concerned is practically two and one half centuries nearer the origin of such methods. But the letter of "noble frankness" with the unquestioned facts which throw light upon it, are alone sufficient to bar Leibniz from the honor of an independent discoverer, for no other reason than that, as we say in the law, he does not come into court with clean hands.

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THE POOR DIENER

How many of us have not felt as we closed an article that we may have thought good, perhaps expressing perfunctory thanks to our patron or instructor or some other figure in the seats of the mighty who took a few minutes time to send us some preparations or cultures prepared by some one else in his laboratory, that there was a hardworked, somewhat pathetic humbler figure back of it all to whom our thanks are far more due than to any of these?

When you take down from the shelf a carefully cleaned, carefully sterilized, cotton-plugged flask and fill it up for your own purposes, and then cheerfully discard it and take another because you got in a tenth of a centimeter too much, when you finish up a couple of hours brisk work and then carry out a trayful of pipettes to the "dirtroom" to be washed up, and leave around a staggering array of dirty glassware too bulky to bother to take out yourself, when you pile up on the sterilizing bench a great lot of used, gone and forgotten cultures for some one else to autoclave, then remember the poor diener.

When you toss over a foul sample of sputum with a "Here Jim, stain this up and look for the bugs," or hack out a bloody mess of tissues from a dead guinea pig and hand them over with a curt "Shove these into Zenker, George, and run 'em through as fast as you can," give credit where credit is due. These are not operations that can be carried on by any old man in the street; these are true science.

Dozens of procedures which we learned with difficulty in school days, we turn over to dieners and technicians, who learned the art from other dieners and technicians and carry it on in a clean-cut mechanical way better than we could do ourselves. God help science if all the dieners should unionize and go on a strike to-morrow.

E. R. L.
SARANAC LAKE

SCIENTIFIC BOOKS

RECENT PALEOBOTANY IN GREAT BRITAIN

THE following survey of paleobotanical researches published in Britain during the war is necessarily superficial; it is, moreover, obviously impossible to draw a clearly defined line between work done in the period immediately preceding the outbreak of hostilities and work completed since August, 1914. No mention is made of papers which, though primarily concerned with recent plants, include references to extinct types. In spite of the fact that national work of one kind or another has absorbed, wholly or in part, energies normally devoted to scientific research the record of achievement amply justifies the statement that the progress of paleobotanical enquiry has not suffered any serious check. Much has been done towards quickening the spirit of research in pure science as well as in relation to problems of great economic importance: the foundations of paleobotanical knowledge have been considerably strengthened and, with the access of greater opportunities and revived interest in research which we confidently expect in the days to come, the results gained during the period of storm and

stress will unquestionably exercise a stimulating and directive influence upon future investigations.

Through the death of Mr. Clement Reid (December, 1917) paleobotany has lost one of the ablest and most careful observers in a neglected field of British botany, namely, the investigation of the composition of European floras subsequent to the advent of the flowering plants as the dominant class. In his later work he had the benefit of the assistance of his wife by whom, it may confidently be expected, questions connected with the origin of the British flora will be further elucidated. Dr. Newell Arber, who died in June, 1918, was one of the most indefatigible and enthusiastic students of ancient floras, particularly those of Paleozoic and later Mesozoic age. He accomplished much in a comparatively short life and by his whole-hearted devotion to research exercised a wide influence upon younger men. Miss Ruth Holden, though an American citizen, left her paleobotanical work in this country at the end of 1916 to join a British medical unit in Russia where she died in April, 1917. By her death paleobotany lost an exceptionally gifted and promising student.

Books.—The second part of "The Cretaceous Flora"[1] by Dr. Marie Stopes, a volume of a series of British Museum Catalogues of the fossil plants in the national collection is devoted to an account of Lower Greensand (Aptian) plants, principally Conifers and extinct types of Cycadophyta. The introductory chapter includes an interesting sketch of the general facies of Lower Greensand floras and a discussion on the climatic conditions under which the plants lived. A remarkable new genus (*Colymbea*) of Cycadophyta is described and new types of dicotyledonous wood. The author's work affords striking evidence of the highly specialized structure of some of the oldest dicotyledonous trees of which we have any detailed knowledge. Volume III. of "Fossil Plants,[2] a text-book for students of Botany and Geology" by the writer of this article published in 1917 continues the account of Pteridosperms and Cycadofilices begun in Vol. II. and deals with recent and fossil Cycadophyta, the Cordiatalés, and fossil gymnospermous seeds. The concluding volume has been printed and will be published as soon as circumstances permit.

Papers.—1. *Pre-Carboniferous Plants.* One of the most important paleobotanical contributions of recent years, a paper of exceptional interest, is the memoir by Dr. Kidston and Professor Lang[3] on a new genus of plants, *Rhynia Gwynne-Vaughani,* beautifully preserved as an almost pure growth in beds of chert in the Old Red Sandstone of Aberdeenshire. The chert consists of a series of peat beds which were periodically inundated and eventually covered by a layer of sand. The silicified peat is almost entirely composed of the prostrate stems and rhizomes of the leafless and rootless *Rhynia.* This oldest land plant of which the internal structure is at all fully known consisted of a branched underground rhizome attached to the soil by rhizoids bearing occasionally forked, slender, leafless aerial branches. The vegetative organs bore small hemispherical protuberances some of which developed into adventitious branches. The reproductive organs are represented by elongate isosporous synangia probably borne at the end of the main axes. A new group, the Psilophytales, is instituted for this exceptionally interesting plant which is compared with *Psilotum* and with the Devonian *Psilophyton princeps.* Dr. Arber and Mr. Goode[4] record the occurrence of a few fragmentary impressions of land plants from Devonian rocks of North Devon including specimens of slender repeatedly forked axes with terminal cupule-like organs which they refer to a new genus *Xenotheca* believed to represent the fertile shoots of a Pteridosperm.

[1] "Catalogue of the Mesozoic Plants in the British Museum" (Nat. Hist.), The Cretaceous Flora, Pt. II., London, 1915.

[2] "Fossil Plants," Vol. III., Cambridge, 1917.

[3] *Trans. R. Soc. Edinburgh,* Vol. LI., Pt. III., p. 761, 1917. See also British Assoc. Report, 1916, p. 206.

[4] *Proc. Cambridge Phil. Soc.,* Vol. XVIII., Pt. III., p. 89, 1915.

The Devonian species belong to the oldest land-flora so far described from English strata. A paper by Messrs. Don and Hickling[5] gives by far the best account we possess of *Parka decipiens,* a problematical Old Red Sandstone discovered in 1838 and referred to different positions in both the animal and vegetable kingdoms. It occurs, in the form of flat circular or oval flattened mummified bodies enclosing numerous circular groups of spores, in the lower beds of the Caledonian Old Red Sandstone and in passage beds between the Old Red and Silurian. The authors make out a good case for its inclusion in the Thallophyta as an extinct type with Algal affinities. Mr. Don, a student of unusual promise, obtained a commission in the early days of the war and died at Salonika in April, 1916.

2. *Carboniferous Plants.*—Additions have been made to our knowledge of Carboniferous floras by several authors. Dr. Kidston[6] published in 1916 the first of a projected series of papers on plants from the Scottish Coal Measures in which are described two new species of *Sigillaria,* two new types of *Sphenopteris,* and a new species of seed referred to the genus *Lagenospernum.* The same author[7] has described several plants from the Forest of Wyre coalfield and from the Tetterstone Clee Hill coalfield. Dr. Arber[8] in a paper dealing with plants from the Red Clay series and the Middle Coal Measures of the Staffordshire coalfield proposed a new generic name, *Calamophloios,* for casts and impressions of Calamite stems in which the external surface and not the surface of the pith-cast is preserved. These papers on Carboniferous floras supply important data towards a more complete classification of coal-bearing strata in Britain on the basis of the fossil plants. Miss Lindsay[9] contributes new facts in a short account of the method of branching and the phenomena of branch-shedding in *Bothrodendron.*

Dr. Scott in an interesting sketch of the forests of the coal age[10] discusses the evidence afforded by paleobotanical investigations on the conditions under which the plants grew; he draws attention to the high degree of organization exhibited by Paleozoic species, a fact which has not hitherto been sufficiently realized in discussions of problems connected with evolution. The same author[11] has published a valuable and comprehensive account of the genus *Heterangium,* one of the best known examples of the very important extinct Paleozoic group of pteridosperms, plants with fern-like foliage-bearing seeds and possessing anatomical characters denoting a close affinity to gymnosperms. He institutes a new subgenus *Polyangium* to include several species characterized by compound leaf-traces and other distinctive features in contrast to another set of species, in which the leaf-trace is single in origin, referred to the subgenus *Eu-Heterangium.* The Polyangium forms indicate a closer relationship between the Lyginopteridese and the Medulloses and Calamopityeæ than has hitherto been suspected. This paper is an admirable example of the importance of revising from time to time in the light of fresh discoveries our knowledge of extinct genera. Dr. Scott[12] has recently described a new species of another Carboniferous genus founded on petrified stems, *Mesoxylon multirame,* characterized by the presence of many axillary shoots and other morphological features. A preliminary account is added of a small stem associated with *Mitrospermum* seeds which it is believed may belong to Mesoxylon. Dr. Nellie Bancroft's careful re-investigation of Williamson's *Rachiopteris cylindrica*[13] from the Lower Coal Measures of Yorkshire reveals the existence of two types of this fern which she regards

[5] *Quart. Jour. Geol. Soc.,* Vol. LXXI., Pt. IV., p. 648, 1917.

[6] *Trans. R. Soc. Edinburgh,* Vol. LI., Pt. III., p. 709, 1916.

[7] *Ibid.,* Pt. IV., p. 999, 1917.

[8] *Phil. Trans. R. Soc. London,* Vol. 208, Series B, p. 127, 1916.

[9] *Annals of Botany,* Vol. XXIX., p. 223, 1915.

[10] *Trans. Instit. Mining Engineers,* Vol. LIV., Pt. II., p. 33, 1917.

[11] *Jour. Linn. Soc.,* Vol. XLIV., p. 59, 1917.

[12] *Annals of Botany,* Vol. XXXII., p. 437, 1918.

[13] *Ibid.,* Vol. XXIX., p. 531, 1915.

as habitat-forms of one species, the differences in structure being attributed to the influence of water. In this as in many other recently published papers it is satisfactory to find that authors are now paying more attention than formerly to the significance of structural features as indices of climate and habitat. Mr. Sahni's critical morphological study of the branching of the leaf-trace in certain Carboniferous genera of ferns[14] throws light on some previously misunderstood anatomical features and illustrates the value of the application of broad philosophical generalizations based on intensive study of allied forms. Miss Holden's account of the anatomy of two Paleozoic Cardaitalean stems from India;[15] placed in the genus *Dadoxylon,* supply welcome information on the structure of plants belonging to the *Glossopteris* flora: the occurrence of well marked rings of growth in the wood of both species is a fact of special interest from the point of view of the climatic conditions under which the plants of the southern flora flourished. A report of a British Association Committee published in 1917 summarizes opinions on the vexed question of the classification[16] of the older rocks of Gondwana land in which plants of the *Glossopteris* flora are preserved.

Researches of both scientific and economic interest into the composition and mode of origin of coal have in recent years attracted the attention of several workers. The most important piece of work of this kind is that by Dr. Stopes and Dr. Wheeler,[17] a happy combination of expert botanical and chemical knowledge. The authors begin by defining ordinary coal as a "compact, stratified mass of mummified plants free from all save a very low percentage of other matter," that is practically a deposit of plants alone. It is rightly claimed that too little attention has hitherto been paid to research following logical deductions from our knowledge of the chemical composition of plants. The authors deal with modes of accumulation of coal-forming vegetable material action of the solvents on coal, the effect of heat, distillation at different temperatures, microscopic evidence bearing on the constitution of coal derived both from the coal itself and from the petrified tissues preserved in the calcareous nodules of certain coal seams. A very useful bibliography is appended. Mr. Lomax[18] has continued his microscopical analysis of coal seams and discusses the part played by different plants and parts of plants in the composition of coal. Similarly Mr. Hickling,[19] who writes on the micropetrology of coal, reviews previous work and gives the results of original observations; he attributes differences in coal rather to the result of varying degrees or varying modes of alteration than to differences in the nature of the original constituents.

3. *Mesozoic Plants.*—Dr. Arber's memoir, published shortly before his death, on the older Mesozoic floras of New Zealand,[20] is a particularly welcome contribution to our knowledge of the little known botanical history of that country. He deals with Triassic-Rhætic, Jurassic and Cretaceous plants. The author shows that no Palæozoic flora has so far been discovered: the absence of any undoubted examples of the common southern hemisphere genus *Glossopteris* leads him to express the view that New Zealand did not form part of that extensive continent known as Gondwana land in the Permo-Carboniferous period. An account is given of a remarkable petrified forest at Waikawa, Southland, consisting chiefly of some conifers and well-preserved osmundaceous stems. Dr. Arber's work clears up many obscure points and corrects erroneous statements by previous authors.

Important contributions have been made to our knowledge of Jurassic plants, notably the description of a new genus, *Williamsoniella,*

14 *Ibid.,* Vol. XXXII., p. 369, 1918.

15 *Annals of Botany,* Vol. XXXI., p. 315, 1917.

16 British Assoc. Report, 1917, p. 106.

17 Monograph on the Constitution of Coal. Dpt. Scientific and Industrial Research, London, 1918.

18 *Trans. Instit. Mining Engineers,* Vol. L., Pt. I., p. 127, 1915.

19 *Ibid.,* Vol. LIII., Pt. III., p. 137, 1917.

20 New Zealand Geol. Survey, Paleontological Bulletin No. 6, Wellington, 1917.

of Cycadophyta by Mr. Hamshaw Thomas[21] (now Captain Thomas) founded on material collected by him at Gristhorpe bay on the Yorkshire coast. This genus possessed fertile shoots bearing small ovules and interseminal scales crowded on a pyriform axis and surrounded at the base by a whorl of microsporophylls each bearing 5–6 synangia. The bisexual shoots were almost certainly borne in the forks of a slender dichotomously branched stem like that of *Wielandiella*, and there are good grounds for regarding the supposed fern leaves known as *Tacniopteris vittata* as the foliage of this Bennettitalean plant. Mr. Thomas's discovery[22] of a bed of mummified plant remains in the Lower Estuarine series at Roseberry Topping, Yorkshire, enabled him to investigate minutely the epidermal characters of the problematical genus *Thinnfeldia;* he believes that the fragments of leaves and twigs of which the deposit is mainly composed were borne on trees, an interesting suggestion at variance with previous views on the nature of the genus. This author also describes a Yorkshire specimen of *Williamsonia*[23] in the Paris Museum which is probably the male flower of *Williamsonia gigas.*

Miss Holden's account of a new type of coniferous stem, *Metacedroxylon*[24] from the Corallian of Sutherland, Scotland, adds another to an already long list of Mesozoic types exhibiting a mixture of Abietineous anatomical characters. An examination by the same author[25] of impressions of Wealden fronds previously referred to the genus *Cycadites* and believed to be closely allied to the recent *Cycas* shows that they should be transferred to *Pseudocycas.* A paper by Mr. Clement Reid and Mr. Grove[26] on Characeæ from the Purbeck of Dorset gives a preliminary account of their researches into the fossil representatives of this neglected family; they describe a new genus, *Clavator,* characterized by club-like nodes on the stem and by other characters. Dr. Marie Stopes has instituted a new genus, *Planoxylon,*[27] for a Cretaceous New Zealand coniferous stem combining Abietineous and Araucarian features; she suggests that this generalized type points to the existence in the southern hemisphere of an extinct group of conifers of unexpectedly Abietineous affinities. The same author[28] describes the structure of the first specimens of roots of *Bennettites* so far discovered.

Several papers by Dr. Ellis[29] deal with fossil fungi and include descriptions based on characters of doubtful value of some supposed new species from Jurassic and Cretaceous rocks; the author also discusses the rôle of micro-organisms in the formation of ironstones.

4. *Tertiary and Pleistocene Plants.*—Mr. Dutt's careful account of *Pityostrobus macrocephalus,*[30] believed to be allied to *Pinus excelsa,* from the Lower Eocene of the London Basin is an interesting morphological contribution and reveals the occurrence of unusual features in this well-preserved Abietineous cone which have been overlooked by previous authors. Papers by Mr. Clement Reid[31] and by Professor Marr and Miss Gardner[32] extend our knowledge of the Arctic Pleistocene flora of England and of the conditions under which the plants grew.

In his "Notes on *Calamopitys*"[33] Dr. Scott deals with the same fulness and critical insight with the known species of this Lower Carboniferous genus, a type showing certain affinities to *Lyginopteris* and *Heterangium.* We have unfortunately no knowledge of its reproductive organs. The paper contains

21 *Phil. Trans. R. Soc.,* Vol. 207, Series B, p. 113, 1915.

22 *The Naturalist,* January 1, 1915, p. 7.

23 *Proc. Cambridge Phil. Soc.,* Vol. XVIII., Pt. III., p. 105, 1915.

24 *New Phytologist,* Vol. XIV., p. 205, 1915.

25 *Ibid.,* Vol. XIII., p. 334, 1914.

26 *Proc. R. Soc.,* Series B, Vol. 89, p. 252, 1916.

27 *Annals of Botany,* Vol. XXX., p. 111, 1916.

28 *Ibid.,* Vol. XXXI., p. 257, 1917.

29 *Proc. R. Soc. Edinburgh,* Vol. XXXV., Pt. I., p. 110, 1915; *Knowledge,* Vol. XXXIX., p. 73, 1916; *Geol. Mag.,* Vol. IV., p. 102, 1917.

30 *Annals of Botany,* Vol. XXX., p. 529, 1916.

31 *Quar. Jour. Geol. Soc.,* Vol. LXXI., p. 155, 1917.

32 *Geol. Mag.,* Vol. III., p. 339, 1916.

33 *Jour. Linn. Soc.,* Vol. XLIV., p. 205, 1918.

much that is new and is a valuable contribution to the difficult subject of the interrelationship of several Palæozoic plants exhibiting remarkable complex anatomical features.

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SPECIAL ARTICLES

THE BLACK CHAFF OF WHEAT

The continued prevalence of black chaff of wheat in the United States makes it desirable to have a Latin-scientific name for the bacterial organism causing it. This organism resembles *Bacterium translucens* (see *Journal of Agricultural Research,* Vol. XI., p. 625, 1917), cause of the bacterial blight of barley. In cross inoculations on the leaves of seedling plants the barley organism on wheat has proved either non-infectious or has produced small non-typical lesions. On the other hand, inoculation experiments have shown that the wheat organism is practically as pathogenic on barley as it is on wheat and the lesions so produced on barley are indistinguishable from those produced by the barley organism itself. There also appear to be minor cultural differences. It is suggested, therefore, that for the present, at least, the wheat organism be distinguished as *Bacterium translucens* var. undulosum with, in general, the characteristics already given for the species:

Var. undulosum nov. var., cause of the black chaff disease of wheat, produces yellow or translucent stripes on leaves, water-soaked or black stripes on culms, and longitudinal, more or less sunken, dark stripes or spots on the glumes. In moist weather the bacteria often ooze to the surface of the diseased spots or stripes as tiny beads or drops, drying yellowish. From sections of diseased leaves or glumes mounted in water they ooze in enormous numbers (like smoke out of a chimney) making the fluid cloudy. This organism attacks also the kernels, especially at the base causing them to be shrunken and honeycombed with bacterial pockets, but even when the kernels are not attacked their surface is liable to be infected from the diseased glumes. When the disease appears early and is severe the heads are dwarfed. Surface colonies on thin-sown agar plates are circular, pale yellow, smooth (like polished glass) and structureless on the surface, usually homogeneous also by direct transmitted light, but by oblique transmitted light (half-light) the interior is seen to be full of minute waves or interblending striations which persist, and which are best seen with a hand lens. It can be distinguished easily and quickly from accompanying non-parasitic yellow forms by this character alone. Slime copious and very pale yellow on potato agar; on whey agar very copious and bright chrome yellow—slime on this medium deeper yellow and less fluid than that of the barley organism.

Infections have been obtained repeatedly on wheat leaves and glumes. The disease is transmitted to young seedlings by way of the wheat kernels. It occurs in all the wheat states of the Middle West.

For earlier notes consult Science, N. S., Vol. XLIV., No. 1134, p. 432, 1916, the *Journal of Agricultural Research,* Vol. X., No. 1, 1917, and the *Plant Disease Bulletin* (issued by The Plant Disease Survey, Bureau of Plant Industry, U. S. Department of Agriculture), Vol. I., No. 2, 1917, and Vol. II., No. 6, 1918.

Erwin F. Smith,
L. R. Jones,
C. S. Reddy

THE BUFFALO MEETING OF THE AMERICAN CHEMICAL SOCIETY. V

The rapid determination of titanium in titaniferous iron ores: John Waddell. The ore is fused in a silver, copper or iron crucible with sodium peroxide, for about ten minutes. The crucible with the fused mass is brought into a beaker with water, and the disintegrated material dissolved in sulphuric acid. Tartaric acid is added to keep the titanium in solution. Sulphuretted hydrogen is passed through the solution. If a copper or silver crucible has been used, the precipitated sulphide is filtered off, and to the filtrate, ammonia is added and more sulphuretted hydrogen is passed. To the filtrate from the iron sulphide, sulphuric acid is added and the solution is boiled to drive off the